

Careers in Fusion and Fission Energy and Science

at Oak Ridge
National Laboratory



Oak Ridge National Laboratory



AT A GLANCE

Established in **1943**
as part of the Manhattan Project

\$2.2B annual budget

9 national
user facilities

5,400 employees

3,200 visiting
scientists

221 R&D 100 Awards

2 Nobel Prize winners

46 National Academy
members

17 UT-ORNL Governor's Chairs

9 university core
research partners

9 new elements discovered

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Big Science. Big Opportunities.

Oak Ridge National Laboratory (ORNL) was created to help win a war and change the world. We have always adapted to meet national needs, developing expertise, tools, and even entirely new fields to solve the most difficult scientific and technical challenges.

- **We pioneered nuclear energy, science, and engineering**, developing techniques, technologies, and training programs that led to commercialization of nuclear power and creation of the nuclear navy.
- **We produce life-saving medical isotopes** and operate the National Isotope Development Center for the Department of Energy (DOE).
- **We developed neutron diffraction**, a scientific technique available to researchers who use two of the world's most powerful neutron sources at ORNL for studies of materials, medicines, disease progression, and more.
- **We create new materials** including alloys with billion-dollar impacts on industry and unique properties that enable NASA to explore outer space.
- **We build some of the world's most powerful supercomputers**, with three No. 1 systems since 2009 and one of the world's first exascale systems, Frontier, due in 2021.
- **We printed a car** (and a house, jeep, boat ...) to study methods for improving the efficiency and productivity of manufacturing processes that give American industry a competitive edge.
- **We secure the nation** with expertise from across our research portfolio, sending teams worldwide to keep nuclear materials safe, pursuing cybersecurity for the power grid, and more.
- **We discovered the sex-determining role of the Y chromosome** and make breakthroughs in biology from genes to ecosystems, providing insights benefiting biotechnology, biosecurity, and biofuels.
- **We invented radioecology** and lead large-scale experiments in the Arctic and other remote locations.

*Join us on
our quest to
deliver scientific
impact that
changes the
world.*

We always ask, "What's next?" We stand ready for the unexpected. Today, we are applying our expertise in several areas in the global fight against COVID-19, and we are looking to the future.



Building the World's Premier Research Institution

National labs are distinguished by their ability to assemble large teams of experts from a variety of scientific and technical disciplines to tackle compelling national problems. They also design, build, and operate powerful scientific facilities that are available to the international research community.

From the start, ORNL has applied scientific discoveries and new technologies to address pressing challenges in the areas of clean energy and global security and to create economic opportunity for the nation. Today, Oak Ridge is the most diverse of the Department of Energy's 17 national laboratories, providing leadership in energy research and technology, advanced materials, nuclear science and engineering, neutron science, isotope production, national security, environmental and biological sciences, and high-performance computing.

Resources like these enable the US to compete in what former ORNL Director Alvin Weinberg called the arena of "Big Science" and they empower our researchers to pursue knowledge that's fundamental to solving some of our world's greatest challenges.



Biology and Environment

We sequenced the poplar genome and are leveraging these data with ORNL-developed algorithms and supercomputing to engineer better bioenergy feedstocks and more climate-resilient crops.



Fusion and Fission

A multidisciplinary team is printing a microreactor to help industry address high costs and lengthy deployment timelines that threaten the future of nuclear energy—the nation's largest carbon-free energy source.



National Security

The Mobile Uranium Facility equips ORNL staff members to characterize, process, package, and transport uranium materials anywhere in the world. We are using our scientific capabilities to counter enduring and emerging threats to national security.



Materials

We developed a new class of affordable, lightweight superalloys that can withstand temperatures almost 100 degrees Celsius hotter than existing commercial alloys in complex engine parts.



Clean Energy

Our magnetic coils and power electronics enable the extreme fast charging of electric vehicles—wirelessly. ORNL's expertise also supports industry and has set standards for energy efficiency.



Isotopes

We produce unique medical isotopes for life-saving treatments and diagnoses, including actinium-227, a critical material for making a highly effective prostate cancer drug.



Neutron Science

We use neutrons to directly observe battery behavior in pursuit of safer, more reliable energy storage and extended battery life, to study the behavior of drugs in combating disease, and much more.



Supercomputing

Our scientists are cracking the code on opioid addiction using Summit, one of the world's fastest supercomputers, to perform immense calculations on genomic data. Summit provides unique multi-precision computing capabilities that are ideal for artificial intelligence and machine learning applications.



About the Fusion and Fission Energy and Science Directorate

The Fusion and Fission Energy and Science Directorate (FFESD) addresses compelling challenges in fission and fusion energy systems, enabling Oak Ridge National Laboratory to pursue national priorities in current and advanced nuclear research, development, and deployment.

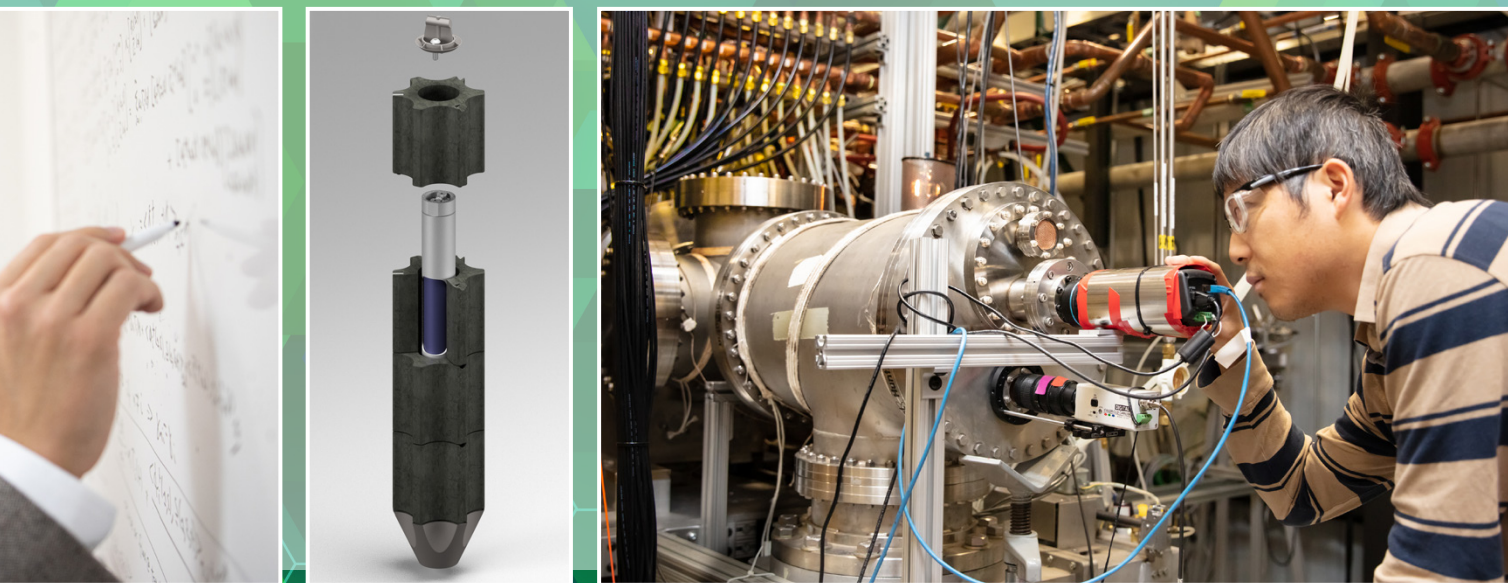
FFESD traces its roots to the X-10 Graphite Reactor, the world's first continuously operated nuclear reactor. The directorate is focusing on fission and fusion technologies; advancing modeling and simulation; and managing the US ITER project.

The directorate's unique facilities, capabilities, and talented scientists and engineers are currently tackling such challenges as extended operations of the current US nuclear reactor fleet; investigating economical and flexible advanced reactor systems; and making fusion energy a viable power source. The directorate leverages synergies between fusion and fission across domestic and international programs.

FFESD leads US ITER, which has the responsibility of designing, fabricating, and delivering hardware for the international ITER fusion project. The directorate also leads the Transformational Challenge Reactor demonstration program, an effort to build the world's first additively manufactured reactor, and the Material Plasma Exposure eXperiment (MPEx), a future world-leading capability that will produce the extreme plasma environments to test materials for use in fusion energy devices.

REVOLUTIONIZING ADVANCED REACTOR TECHNOLOGY

Launched in 2019, the Transformational Challenge Reactor (TCR) demonstration program is led by FFESD researchers and leverages capabilities and expertise from across ORNL. The program is harnessing the latest advances in science and manufacturing to build a microreactor using 3D printing and operate it by 2023. TCR will demonstrate a faster, more affordable path to deploying new nuclear energy systems and lay the groundwork for the nuclear industry to quickly adopt the technology.



The research portfolio for the Fusion and Fission Energy and Science Directorate spans two divisions and the US ITER Project. The directorate advances key science, technology, and engineering capabilities while building a competitive world-class workforce to meet our future mission needs.

- **Fusion Energy Division** experts are developing the understanding required for the deployment of practical fusion energy systems. This includes realizing next-generation fusion materials, achieving a sustainable fuel cycle, ensuring adequate power exhaust in high-confinement systems, and maintaining long-term control of the plasma. Researchers are building a foundation for sustaining burning plasma and using theory and modeling to resolve critical issues and to come up with workable designs for future fusion devices. The division is also identifying and developing remote-monitoring technologies for harsh environments, including fusion devices.
- The **Nuclear Energy and Fuel Cycle Division** provides science and technology breakthroughs to extend the lives of current nuclear plants, to accelerate the deployment of new, advanced nuclear-power technologies, to further the state of the art in modeling and simulation capabilities for nuclear application, to deliver new insights into nuclear fuel performance at all stages of the fuel cycle, and to provide innovations for nuclear fuel systems. The division is leading the Transformational Challenge Reactor demonstration program and also developing other advanced reactor concepts; assessing and improving effective, cost-efficient nuclear systems; and developing and testing molten-salt components and other energy conversion methods.
- The **US ITER Project** is working with industry, universities, and national laboratories to deliver 12 hardware systems for the ITER fusion research facility under construction France. The ITER tokamak will enable the study and control of burning plasmas, an essential step in fusion energy development.

AT A GLANCE



300 scientists, engineers, and technical support staff



FY 20: \$225 million R&D budget and \$242 million in US ITER funding



14 reactors built and operated by ORNL when the Transformational Challenge Reactor goes critical in 2023



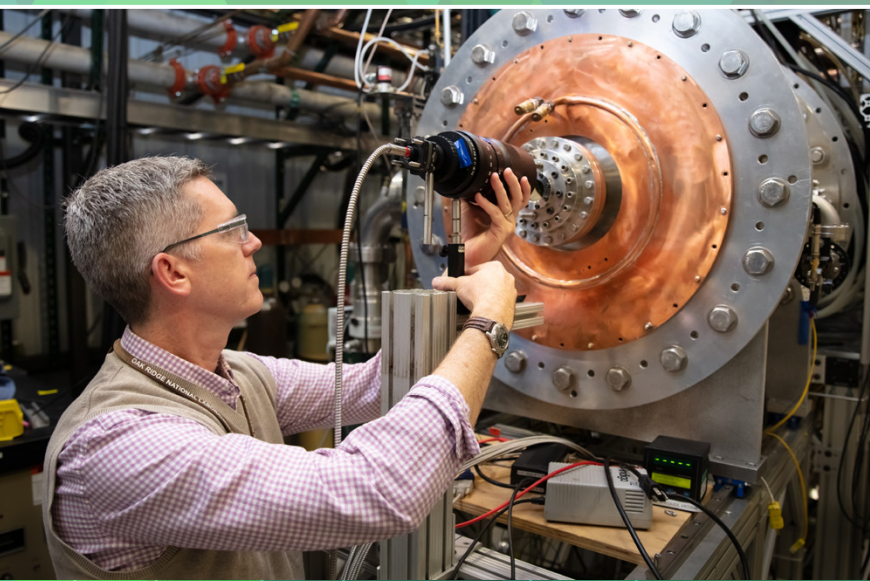
Over 50 years of contributions to fusion science and technology around the world



35 nations representing 80% of the world's population are collaborating to build ITER



10 MW/m² heat flux produced by MPEX similar to what spacecraft experience reentering Earth's atmosphere



Continuing ORNL's Nuclear Legacy and Impact

Established in 2020 as part of Reimagining ORNL, FFESD is aligning the Lab's nuclear science and engineering capabilities for maximum impact on the future of nuclear energy. Having built and operated 13 nuclear reactors in its history, ORNL is fertile ground for nuclear innovation. In the past decade, the Lab has led the Consortium for Advanced Simulation of Light Water Reactors, DOE's first energy innovation hub; developed a new accident tolerant fuel cladding and handed it to industry for testing; and managed the fabrication of the 60-foot-tall central solenoid magnet for ITER. Each of these milestones represents the unique impact of ORNL and how it will shape the coming decade of fission and fusion energy research and development.

Ten-Year Vision

Over the next decade, we will produce world-leading impacts in nuclear science and engineering, helping produce clean, economical nuclear energy, a viable path for fusion energy, and oversee the nation's contributions to ITER.

Our vision enables us to:

- Establish ORNL as the nation's fusion energy laboratory by delivering the technology to enable fusion energy systems, delivering essential systems for ITER research operations, fully leveraging MPEX, establishing new research and development capabilities, and growing our public-private partnerships.
- Advance the path to fusion energy and burning plasma research with initial operations of the ITER tokamak.
- Demonstrate successful engineering of high-performance fusion technologies for a reactor-scale fusion environment.
- Operate ORNL's 14th reactor—the Transformational Challenge Reactor—and showcase the rapid deployment of advanced reactor technologies unlike anything the world has seen.
- Accelerate reactor deployment through partnerships with the reactor community, the development of new fission technologies, and by helping industry adopt our world-leading modeling and simulation tools.
- Further our leadership in nuclear fuels and fuel cycle technology, from exploring new types of promising fuels to improving confidence in the management of used fuel.





Lab of the Future

In May 2020, we launched an internal initiative to strategically expand opportunities for scientific leadership aligned with growth in key programs, mission needs, and emerging research areas. As part of the effort, ORNL's Leadership Team considered how to sustain global leadership in research and development, a relentless pursuit of operational excellence, and an inclusive environment that fosters innovation, creativity, and collaboration.

Our goal is to serve the nation as the world's premier research institution, empowering leaders and teams to pursue breakthroughs in an environment marked by operational excellence and engagement with the communities where we live and work.

Join Us!

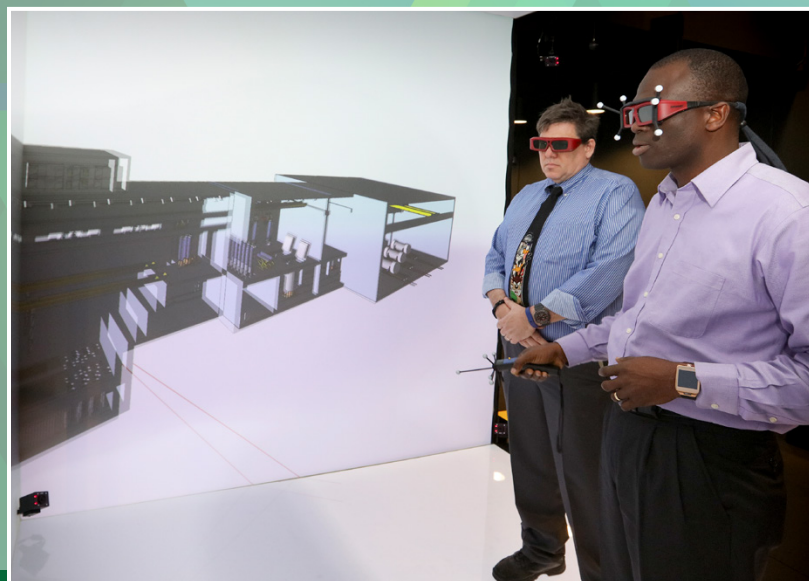
ORNL's research groups and sections are the building blocks of a premier research institution and will focus on the disciplines essential to our missions and to leadership in emerging fields. We're creating new, focused teams to accelerate leadership in core capabilities identified by our sponsors, partners, and research staff.

- New **Section Heads** will provide R&D leadership to groups in common thematic areas, set consistent expectations, coordinate across disciplines, and help to align the activities of groups with the vision of the directorate and the Lab as a whole.
- New **Group Leaders** will sustain individual excellence in research and development while building a group of peers who pursue global leadership and exemplify ORNL's commitment to solving some of the world's most difficult problems.

Leadership Opportunities in Fusion and Fission Energy and Science

- Burning Plasma Foundations
- Fusion Science, Technology, and Engineering
- Advanced Reactor Engineering and Development
- Nuclear Modeling & Simulation Development and Deployment
- Nuclear Criticality, Radiation Transport, and Safety
- Fuel Development
- Integrated Fuel Cycle

*We're seeking
passionate leaders who
will help us become the
world's premier
research institution.*



Community and Culture

The strong partnership between DOE and ORNL contractor UT-Battelle, LLC, has created a national resource that draws outstanding researchers in a wide range of disciplines to world-class facilities where they tackle fundamental scientific challenges, couple discoveries with applied research, and work with industry to translate results into commercial applications. The work of the laboratory is being performed safely and efficiently in a modern campus setting. Throughout the region, ORNL is regarded as a high-value asset for innovation, education, and economic development.

Discover East Tennessee

East Tennessee offers a variety of resources and experiences ranging from mountains, rivers, lakes, and a full menu of outdoor adventures to championship college teams and minor-league baseball to the arts and culture of Knoxville, including the internationally recognized [Big Ears Festival](#). The city is recognized as one of the country's best places to live, in part thanks to its [Urban Wilderness](#) system linking residential and commercial areas with the great outdoors. ORNL is within a day's drive of 50 percent of the nation's population and all of the East Coast's major cities.

Our Workforce

ORNL is a great place to chart your own research course, work with like-minded colleagues, and build an extraordinary career. With more than 5,400 employees representing more than 60 countries, we assemble teams of experts from diverse backgrounds, equip them with powerful instruments and research facilities, and address compelling national problems.

In addition, ORNL offers professional development training at no cost to employees, provides professional networking opportunities, and sponsors employee resource groups that support diversity and inclusion efforts across the lab.

Diversity and Inclusion

ORNL's ability to build and sustain a highly skilled workforce in a rapidly changing competitive environment for talent is greatly influenced by our ability to plan and forecast workforce needs and promote diversity. Maintaining an inclusive environment is a business imperative that focuses on people in all areas of the laboratory and on maximizing the unique talents of individuals, teams, and business partners to pursue world-leading scientific impact.



We Welcome Your Application

Our challenge now is to sustain our leadership and build on our success. Thank you for your interest in ORNL and how we are helping to address some of the big science challenges facing our nation and the world.

Apply Today

Apply at jobs.ornl.gov

Equal Employment Opportunity

ORNL is an equal opportunity employer committed to a diverse and inclusive workplace that fosters collaborative scientific discovery and innovation. All qualified applicants, including individuals with disabilities and protected veterans, are encouraged to apply.

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